

Photons, the Cause of Refraction, and the Nature of the Vacuum

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A **photon** is massless, [d] has no electric charge,[18][19] and is a stable particle. **In a vacuum, a photon has two possible polarization states.** The photon (Greek: φῶς, phōs, light) is a type of elementary particle. It is the quantum of the electromagnetic field including electromagnetic radiation such as light and radio waves, and the force carrier for the electromagnetic force. Photons are massless,[a] so they always move at the speed of light in vacuum, 299792458 m/s (or about 186,282 mi/s). The photon belongs to the class of bosons but they are also **vacuum waves**.

A **soliton** or solitary wave is a **self-reinforcing wave packet that maintains its shape while it propagates at a constant velocity.** Solitons are caused by a cancellation of nonlinear and dispersive effects in the medium. (Dispersive effects are a property of certain systems where the speed of a wave depends on its frequency.) Solitons are the solutions of a widespread class of weakly nonlinear dispersive partial differential equations describing physical systems.

The **vacuum** does not act as a nonlinear and dispersive medium. **This is why photons [and gravity waves] are solitons that do not lose their energy, frequency, or wavelength if they do not interact with matter or matter generated energy fields as the propagate throughout the universe.**

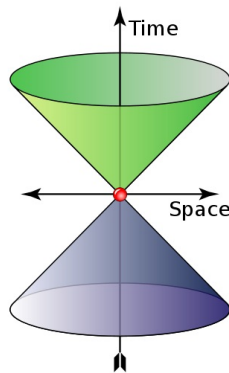
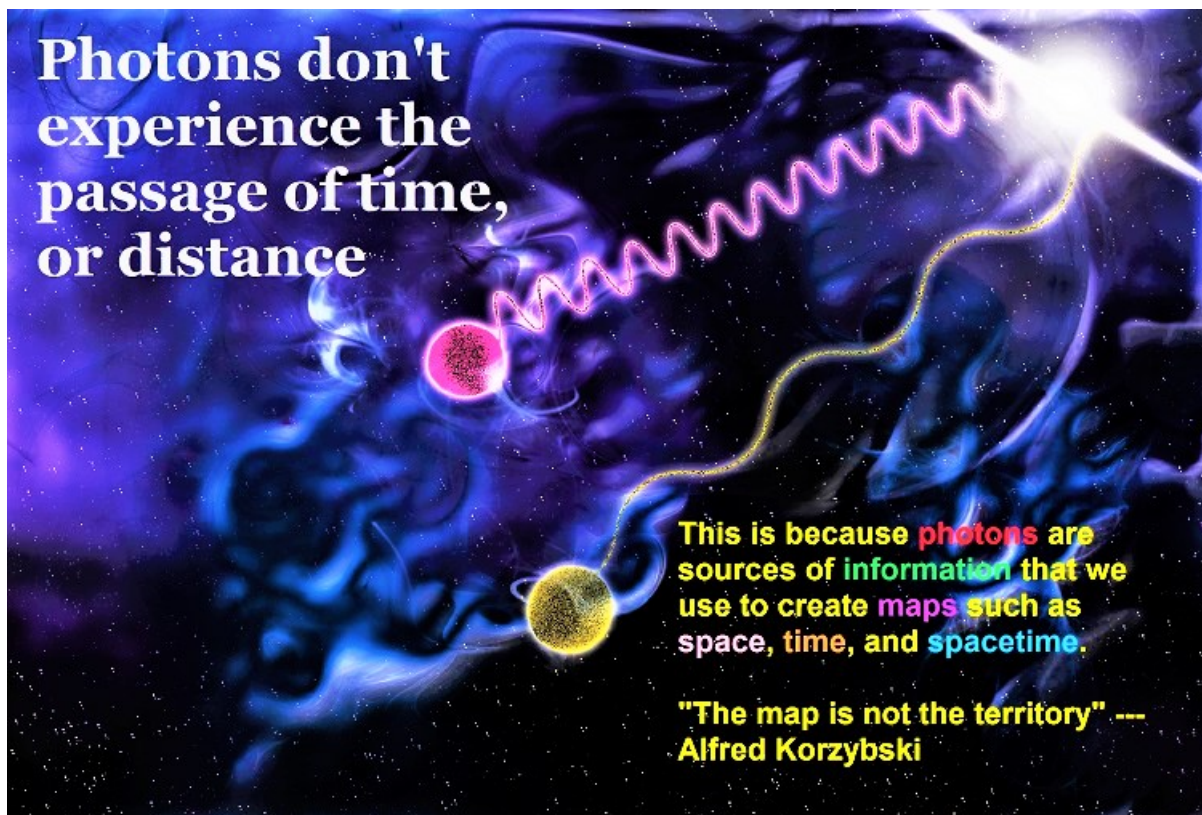


Figure 1. The light cone shows possible values of wave 4-vector of a photon. The "time" axis gives the angular frequency ($\text{rad} \cdot \text{s}^{-1}$) and the "space" axis represents the angular wave-number ($\text{rad} \cdot \text{m}^{-1}$). *Green and indigo represent left and right polarization. Note: this figure assumes that light cones have a physical reality in which time is a dimension.* This is a false model in that time does not exist as a dimension! The vacuum polarization effects are due to the nature of a photon as a perturbation of the vacuum energy. The photon is a soliton **surface effect** on and of the vacuum sea of energy which is not empty or a zero point reference!



The **refractive index** and the apparent slowing down of photons near matter is a result of the surface tension of the vacuum around a particle. A result of the enhanced vacuum energy around matter. The refractive index is a measure of the surface tension of the multi-vacuum around matter. Working backwards one can calculate the total energy of the vacuum around matter from the refractive index...i.e. the slowing of photons close to matter is a measure of the topological and therefore the missing mass and dark energy components properties of the vacuum. This points to a way through optics to develop an experimental method to test the theory of the multi-vacuum universe and a way to identify missing mass and dark energy as components of the vacuum. Photons are vacuum solitons. This helps to explain how they can travel through the great distances of space without decaying. The condensed wave packet that is used to describe individual photons is a result of the soliton nature of the energy representing waves on the vacuum surface. This means that the vacuum is a complex sea of energy as discussed in my other papers.

Refraction is the interaction of photonic solitons [vacuum waves] with observable matter resulting from the surface tension of the vacuum that drags the photons to a slower speed thus leading to a trajectory change in side the collective refractive matter. The photons speed up to the carrying velocity [i.e. standard vacuum velocity, c =speed of light, as seen in laboratory environments] of the vacuum when clear of the matter. This is due to the conservation of total energy because the surface tension of the vacuum provides energy to the photon by the matter so the total energy of the photon:

$$E [\text{photonic soliton}] = h\nu_{\text{photon}} = E_{[\text{surface tension of vacuum near matter}]} + E_{[\text{refractive matter}]}$$

Note that photons are carriers of information when analyzed for their spectral characteristics, direction of their source, intensity of photon bundles and therefore can be used to create maps of change in their sources and therefore time derived as a construction from the information content of these arrows of time. In a sense photons are the links between nodes in a causal networks throughout the vacuum where their function is to act as vectors between the nodes showing the direction and flow of information carried by these ad hoc "arrows of time".

This means that photonic solitons or photons can be used to probe the deep sea of vacuum energy thus examining the proper nature of the vacuum as a reservoir of missing mass, dark energy and cosmological expansion of the universe.

In order to understand how photons properties do not 'age', decay or become 'tired' while propagating through the universe we must see that they are **vacuum waves** [including **gravity waves**] not through empty space but solitons of the vacuum media which is a deep sea of energy that we take for granted to be the zero point energy between islands of observable matter since we, like the photons, are floating on top of this ocean surface of the universe that contains all the missing mass, dark energy and observable cosmological expansion.

In the following three figures we see that **photons** or **photonic solitons** are waves on the vacuum sea of energy. The various energy levels of the vacuum are also illustrated along with testable experiments.

MISSING MASS & ENERGY AS RELATIVE VACUUM LEVELS

[SCOTT M. HITCHCOCK]
[4/27/13 7:52AM EST]

NON-CASIMIR REGION

$$d_{m,m_2} \gg d_p$$

CASIMIR DETECTOR
IF: CASIMIR VACUUM
 $d_{m,m_2} = d_{\text{CASIMIR}} = n d_p$

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WHAT WE SEE

VAC_{MM}

VAC_{ME}

[LIGHT] $M_{\text{OBS}} \equiv$ OBSERVABLE MASS

[DARK] $M_{\text{MM}} \equiv$ MISSING MASS

[DARK] $M_{\text{E}} \equiv$ MISSING ENERGY

EXPERIMENTAL DESIGNS INCLUDE TEST FOR VACUUM LEVEL TRANSITIONS

EXPERIMENTAL DOMAIN OF PHOTON/PARTICLE SCATTERING & DECAY EVENTS & PHOTON ENERGY SHIFTS

THEN OBS. 'VACUUM' PENETRATES INTO 'MISSING' MASS & ENERGY DOMAINS

I.E. 3 VAC LEVELS
I, II, III

H
H
H

COLOR CODE

OBSERVABLE MASS & ENERGY

$|\psi_{\text{OBS}}\rangle \Rightarrow \text{I}$

MISSING MASS

$|\psi_{\text{MM}}\rangle \Rightarrow \text{II}$

MISSING ENERGY

$|\psi_{\text{ME}}\rangle \Rightarrow \text{III}$

MULTI-VACUUM UNIVERSE

DISTANCE

(UNITS OF PLANCK DISTANCE (LENGTH))
 $d_p = 1.6 \times 10^{-35} \text{ m}$

$$|\psi_{\text{U}}\rangle = |\psi_{\text{OBS}}\rangle \otimes |\psi_{\text{MM}}\rangle \otimes |\psi_{\text{ME}}\rangle \text{ CURRENT EPOCH}$$

WHERE: $|\psi_{\text{VAC OBS}}\rangle \equiv |\psi_{\text{MM}}\rangle \otimes |\psi_{\text{ME}}\rangle$
MIXED STATE

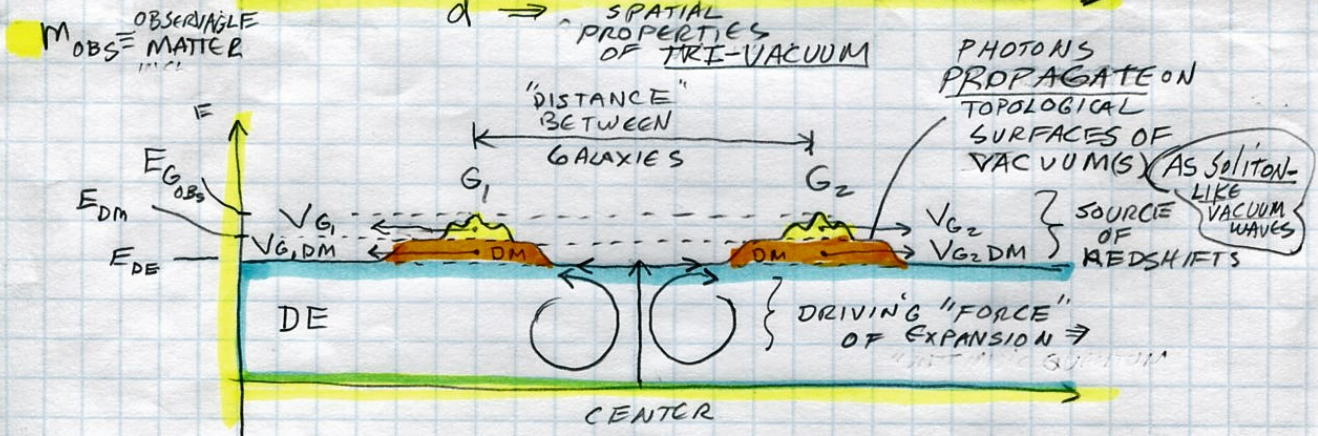
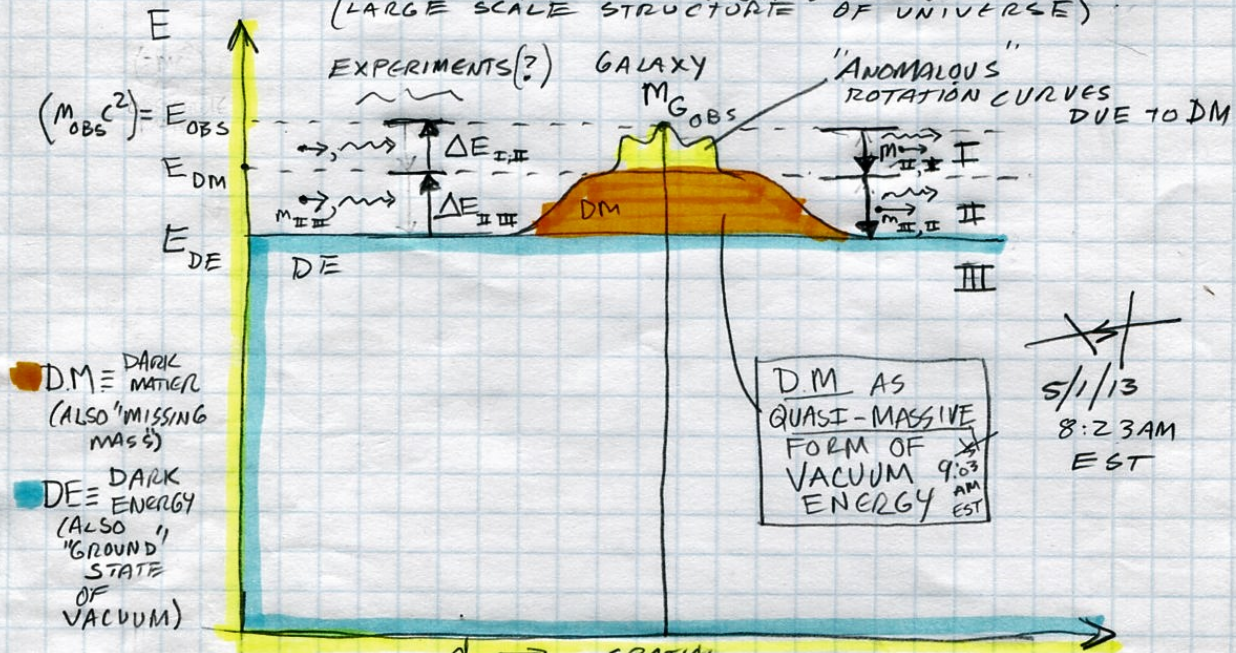
* FIRST THOUGHTS: ABOUT MISSING MASS/ENERGY PROBLEM,
MISSING MASS/ENERGY IS EMBEDDED IN VACUUM
WHERE VACUUM HAS AT LEAST 3 STATES (TOPOLOGICAL [X]
INTERFACES) DEPENDING ON DISTRIBUTION OF OBSERVABLE
MATTER/ENERGY \Rightarrow NOTE GRAVITATION EFFECTS
ARE TOPOLOGICAL PROPERTIES OF MULTISTATE VACUUM
 \Rightarrow EXPANSION ACC. OF BIG BANG DUE TO PHASE TRANSITION
ENERGY OF $|\psi_{\text{MM}}\rangle \otimes |\psi_{\text{ME}}\rangle$ DE-COUPLING OF VACUUMS

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EVOLUTION OF VACUUM STATES

→ COSMIC PHASE TRANSITIONS OF "VACUUM"
(LARGE SCALE STRUCTURE OF UNIVERSE)



① DM "TRAVELS" WITH M_{OBS}

② BOTH DM & M_{OBS} ARE "PRECIPITATED" →

PHASES "ANALOGOUS" WITH ICEBERGS IN OCEAN

DE "SOURCE" OF ACCELERATED EXPANSION

M_{OBS} IS "SOLID STATE" OF DE - ANALOGY

DM IS PHASE TRANSITION BETWEEN DE AND M_{OBS}

ALL "MISSING" MASS AND ENERGY ARE VACUUM COMPONENTS OF THE MULTI-VACUUM UNIVERSE

THE MULTI-VACUUM UNIVERSE AND "BLACK" HOLES

5/30/2016

